



NEWS RELEASE

UNITED STATES AIR FORCE

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August 29, 2005

DE RELEASE NO. 2005-33

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RESEARCH LAB DEVELOPS SYSTEM THAT PREDICTS PROBLEMS

KIRTLAND AIR FORCE BASE, N.M. – Intelligent computer software capable of predicting when systems are about to break down or need special attention is being developed by the Air Force Research Laboratory here, expecting to produce more effective operations and large cost savings.

The technology has already been used to improve the reliability of high-power advanced chemical lasers, and nearby computer chip manufacturer Intel is expected to save millions of dollars a year by installing the technology on just one portion of its production line.

The technology, called prognosis, uses advanced software to predict conditions, circumstances and faults. It is being developed by Victor Stone, a computer engineer at the laboratory's Directed Energy Directorate, and Dr. Mo Jamshidi, a professor at the nearby University of New Mexico and director of the university's Autonomous Control Engineering Center. Jamshidi is temporarily employed by the directorate under a special arrangement.

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While prognosis can include diagnostic techniques and statistical analysis, it also involves computer software tools that provide a level of sophistication characterized as “intelligent.” Included are: a variety of neural network systems, fuzzy logic, pattern recognition, data mining, classical expert systems, and hierarchical and hybrid systems. No one tool works in every situation but the Air Force’s prognosis system can select the most appropriate tool for a particular situation or use multiple tools that transcend traditional collecting and detecting systems to ones that can predict.

Thus far Stone and Jamshidi have been developing a test bed system, working to improve the operation of chemical lasers at the directorate. Through Jamshidi’s university affiliation the two are able to enlist several students to assist them in their work. In return, the students are gaining experience with a state-of-the-art technology.

Stone and Jamshidi are also working with technicians at Intel Corp in nearby Rio Rancho on a Cooperative Research and Development Agreement that is expected to benefit the Air Force and Intel.

If a prognosis process is installed on just one portion of Intel’s production line, Stone and Jamshidi believe the saving will be \$7 million a year. Intel employees are currently providing Stone and Jamshidi with some of the information they need to develop and implement a system tailored to Intel’s needs.

The Directed Energy Directorate benefits by validating prognosis techniques in the process of solving real problems.

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“Prognosis goes beyond using instrumentation to collect information and systematically keep track of a process” said Stone. “It also goes beyond collecting and using information to identify the cause of a phenomenon or detect failures and abnormal behavior. Those processes look at things the way they are, not the way they will be, which is where prognosis steps in.”

By knowing what will happen, operators can plan an orderly shutdown or can continue operating in a safe, but degraded, mode.

“There are significant advantages to performing maintenance on high-value equipment when needed instead of on a periodic basis,” notes Stone. “The equipment can be safely operated longer, which improves productivity and saves money.”

Prior to computers, equipment was monitored by people, which Stone explained was a manual, ad-hoc process. Minicomputers were introduced in the 1970s for high-value equipment monitoring, followed by personal computers in the 1980s. Both needed humans to interpret the information. He remarked that by the 1990s, built-in test equipment and diagnostics were added, which are pervasive in today’s environment.

Stone and Jamshidi are also working together on another “project”: Stone is a doctoral candidate at the University of New Mexico where Jamshidi is Stone’s thesis advisor and committee chairman. Jamshidi notes that Stone has already passed the comprehensives and qualifier; and is nearing the end of the program.

In the near future, Stone’s work in prognosis will contribute intelligent software to existing processes as the next generation in efficiently operating and maintaining complicated, high-value systems.